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SYSTEM AND METHOD FOR SENDING CALLED PARTY CALLER IDENTIFICATION INFORMATION TO A FORWARD-TO TELEPHONE DEVICE IN A COMMUNICATIONS SYSTEM

BACKGROUND OF THE INVENTION

1. Technical Field:

The present invention relates generally to an improved communications system and in particular to a method and apparatus for improved call forwarding in a telecommunication system. Still more particularly, the present invention relates to a method, apparatus, and computer instructions for providing caller identification information of a called number to a forward-to telephone device terminating a call.

2. Description of Related Art:

A well known signaling service available in many telecommunication systems is call forwarding. Call forwarding is a local area switching service that allows an in-coming call to be routed to another location. Many central offices and private branch exchanges feature various call forwarding services. Another well-known and popular local area switching service is caller identification (caller ID). Caller ID is a service where information of a calling party is sent to the terminating number. In the public switched telephone network, caller ID information is sent to the terminating, or called, party between the first and second ring signals of an incoming call.

When a subscriber has both call-forwarding and caller ID enabled, the calling number of the originating, or calling, device is forwarded with call setup data and communicated to the forward-to telephone device. Accordingly, the subscriber receiving a forwarded call receives the caller ID information of the calling party at the forward-to telephone device where the call is directed.

Often times, a subscriber will have incoming calls that are directed to multiple phone numbers forwarded to another location. For instance, a subscriber may have incoming calls to his home phone and his work phone forwarded to his cell phone. If caller ID is enabled, the subscriber will receive the caller ID information of the originating device at the subscriber's cell phone when calls are forwarded from either the home or office number. In such a situation, it is often desirable to know to which telephone device a forwarded call was originally directed. For example, when receiving a forwarded call, the subscriber may want to accept any call being forwarded from the work phone but may only want to accept calls forwarded from the home phone from callers whose caller ID information the subscriber recognizes. In current implementations of call forwarding, the subscriber is unable to discern any information regarding the originally called number. Thus, for example, when an incoming call is directed to the forward-to number and the subscriber does not recognize the caller ID information, the subscriber has no way of

knowing if the incoming call was directed to the home phone or the office phone.

Therefore, it would be advantageous to have an improved method, apparatus, and computer instructions for supplying caller ID information of a called telephone device to a forward-to telephone device as a call forwarding service feature. It would be additionally advantageous to forward caller ID information regarding a call originating telephone device and the called telephone device to a forward-to telephone device. It would still be further advantageous to provide caller ID information of a call originating telephone device and a called telephone device to a forward-to telephone device in a manner that enables display of caller ID information of both the call originating telephone device and the called telephone device without modification of existing caller ID equipment.

SUMMARY OF THE INVENTION

The present invention provides a method, computer program product, and a signaling system for conveying caller identification information of a called party to a forward-to telephone device in a communications system. A call set up message is received at a switching system servicing a called telephone device. The call set up message is determined to be forwarded to a switching system servicing a forward-to telephone device. Caller identification information of the called telephone device is inserted into a caller identification field of the call set up message.

BRIEF DESCRIPTION OF THE DRAWINGS

The novel features believed characteristic of the invention are set forth in the appended claims. The invention itself, however, as well as a preferred mode of use, further objectives and advantages thereof, will best be understood by reference to the following detailed description of an illustrative embodiment when read in conjunction with the accompanying drawings, wherein:

Figure 1 is a communications network in accordance with a preferred embodiment of the present invention;

Figure 2 is a block diagram of a communications device to which caller identification information may be transmitted according to a preferred embodiment of the present invention;

Figure 3 is a block diagram of a telecommunication signaling system in which a preferred embodiment of the invention may be implemented;

Figure 4 is a block diagram of a data processing system that may be implemented as a central office in accordance with a preferred embodiment of the present invention;

Figure 5 is a message flow diagram illustrating call set up signaling when a call originating telephone device places a call to a called telephone device in accordance with a preferred embodiment of the present invention.

Figure 6 is a diagrammatic illustration of an initial address message as received by a central office in accordance with a preferred embodiment of the present invention; and

Figure 7 is a diagrammatic illustration of the initial address message described with reference to **Figure 6** after processing by the receiving central office in accordance with a preferred embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

The preferred embodiment of the present invention and its advantages are best understood by referring to **Figures 1** through **7** of the drawings, like numerals being used for like and corresponding parts of the various drawings. With reference to **Figure 1**, a communications network is depicted in accordance with a preferred embodiment of the present invention. Communications network **100** is an example of a communications network in which the present invention may be implemented. Communications network **100** may include various networks, such as a public switched telephone network (PSTN), an integrated services digital network (ISDN), the Internet, or a fiber distributed data interface (FDDI) network. Communications network **100** may include copper wire, fiber optics, and wireless transmission links such as time division multiple access or code division multiple access links to provide voice and data transmissions.

Within communications network **100**, caller ID information may be sent using signaling system #7 (SS7), which is a protocol used to handle setup, termination, supervisory data, and other data regarding a voice call. Caller ID (CID) information is data containing calling party information, such a calling party's telephone number and a subscriber name of the subscription associated with the calling party number. Additionally, SS7 enables other telephone service features such as call screening and call forwarding. Call forwarding is a

service feature that redirects calls directed to a phone number to another device having a different phone number.

In the illustrative examples, various telephone devices are connected to communications network **100**. For purposes of discussion, assume a user of call originating telephone device **102** initiates a call to called telephone device **104**, which has a call-forwarding service feature enabled. Additionally, a subscriber profile associated with called telephone device **104** specifies that all calls directed to called telephone device **104** are to be forwarded to forward-to telephone device **106**. In the illustrative example, call originating device **102** has a telephone number NPA-NXX-0001, called telephone device **104** has a telephone number NPA-NXX-0002, and forward-to telephone device **106** has a telephone number NPA-NXX-0003. In this example, NPA is a three digit numbering plan area, or area code, and NXX is a three digit central office identifier.

An initial address message (IAM), used for call setup between call originating telephone device **102** and forward-to telephone device **106**, is conveyed through communications network **100** by way of a SS7 network infrastructure. The IAM message includes calling party CID information that is displayed by forward-to telephone device **106** when the call setup is completed and a ring signal is sent to forward-to telephone device **106**. Thus, a user of forward-to telephone device **106** receives a visual display of CID information associated with call originating telephone device **102**. However, no CID information is provided to forward-to telephone device

106 that identifies called telephone device **104** in conventional signaling arrangements. The present invention provides a technique for providing CID information to forward-to telephone device **106** associated with called telephone device **104** as well as call originating telephone device **102**.

Figure 2 is a block diagram of a communications device, such as forward-to telephone device **106** in **Figure 1**, to which caller identification information may be transmitted according to a preferred embodiment of the present invention. Communication device **200** is a telephone that includes processor **202** and memory **204** and may take the form of a land line telephone, a wireless mobile phone, or another communication device suitably adapted for interfacing with the PSTN or a wireless telecommunication system. Processor **202** functions to control operation of communication device **200** and may be a general-purpose microprocessor operating under the control of instructions stored in a memory, such as memory **204**, or device-specific circuitry for controlling the operation of the telephone device.

Processor **202** is connected by system bus **206** to transmitter **208**, receiver **210**, keypad **214**, display **216**, and audio processor **218**. Keypad **214** is the user interface for non verbal input in these illustrative examples and may be a numeric keypad and may include other function buttons or alpha character buttons. Keypad **214** generates signals, in these examples, which are dual tone multi frequency (DTMF) signals used by touchtone telephones.

Display **216** in communication device **200** may be any type of display device including a liquid crystal display (LCD) or other known displays, such as a cathode ray tube or active matrix display. Modem **226** is adapted to demodulate frequency shift keying (FSK) modulated data. Processor **202** supplies demodulated FSK data including CID information for driving display **216**.

Transmitter **208** and receiver **210** are coupled to a telephone signal by interface **224** to provide full duplex communication. The telephone signal may be provided by a telephone line in a land-based telephone or an antenna, for a wireless telephone. Audio processing circuit **218** provides basic analog audio outputs to speaker **220** and accepts analog audio inputs from microphone **222**. Received signals are demodulated and decoded by receiver **210**. Transmitter **208** encodes and modulates signals passed to it by processor **202** or audio processor **218**. The output of the transmitter is amplified by power amplifier **212** to control the power level at which the signal is transmitted. Those of ordinary skill in the art will appreciate that the hardware depicted in **Figure 2** may vary.

Figure 3 is a block diagram of a telecommunication signaling system **300**, such as an SS7 network, in which a preferred embodiment of the invention may be implemented. Call originating telephone device **102**, called telephone device **104**, and forward-to telephone device **106**, are connected with respective central offices (COs) **310**, **312**, and **314**, also referred to as public exchanges. Telecommunication signaling system **300** also includes

signaling transfer points (STPs) **320**, **322**, and **324**. Each of STPs **320** and **324** are connected with respective service control points (SCPs) **330** and **332**. SCPs **330** and **332** provide a front end to respective database systems, such as line information databases (LIDBs) **331** and **333**.

COs **310**, **312** and **314** are carrier facilities where subscriber lines are joined and provide switching functions for connected telephone devices. In the illustrative telecommunication signaling system **300**, CO **310** provides originating and terminating switching services to call originating telephone device **102**, CO **312** provides originating and terminating switching functions for called telephone device **104**, and CO **314** provides originating and terminating switching functions for forward-to telephone device **106**. COs **310**, **312** and **314** may be implemented as, for example, 1AESS or 5ESS switches manufactured by Lucent Technologies, Inc., DMS-100 switches manufactured by Nortel Networks Corporation, or the like.

STPs **320** and **322** are packet switches for enabling common channel interoffice signaling, namely the signaling system #7. STPs **320** and **322** facilitate set up and tear down of phone calls, out of band call information signaling, and relay of information between COs and SCPs. STPs **320**, **322**, and **324** may be implemented as, for example, a BroadBand STP manufactured by the Nortel Networks Corporation.

SCPs **330** and **332** are implemented as computers that interface with database systems. For example, LIDBs **331** and **333** store subscription profiles of telephone devices

local to the particular SCP. SCPs **330** and **332** also interface with databases that provide translation and routing data required for delivering advanced network services.

Referring to **Figure 4**, a block diagram of data processing system **400** that may be implemented as a central office, such as CO **312** in **Figure 3**, is depicted in accordance with a preferred embodiment of the present invention. To simplify the discussion, only the components of data processing system **400** for performing network signaling are shown. It is understood that implementation of CO **312** includes voice switching hardware and software as well as other functional entities not shown. Thus, the description of data processing system **400** is representative of, for example, an SS7 adjunct that may be collocated with a voice switching CO or may be representative of a portion of a CO adapted to perform circuit switching functions and network signaling functions. Data processing system **400** may be a symmetric multiprocessor (SMP) system including a plurality of processors **402** and **404** connected to system bus **406**. Alternatively, a single processor system may be employed. Also connected to system bus **406** is memory controller/cache **408**, which provides an interface to local memory **409**. I/O bus bridge **410** is connected to system bus **406** and provides an interface to I/O bus **412**. Memory controller/cache **408** and I/O bus bridge **410** may be integrated as depicted.

Peripheral component interconnect (PCI) bus bridge **414** connected to I/O bus **412** provides an interface to PCI

local bus **416**. A number of network adapters such as modems, 10/100 baseT Ethernet interface cards, and T1 interface cards, may be connected to PCI local bus **416**. Typical PCI bus implementations will support four PCI expansion slots or add-in connectors.

Additional PCI bus bridges **422** and **424** provide interfaces for additional PCI local buses **426** and **428**, from which additional modems or network adapters may be supported. In this manner, data processing system **400** allows connections to multiple computers, routers or other devices in communications system **100**. A memory-mapped graphics adapter **430** and hard disk **432** may also be connected to I/O bus **412** as depicted, either directly or indirectly. Data processing system **400** includes software executed by processor **402** for modifying a call setup message, such as an initial address message, for enabling delivery of CID information regarding called telephone device **104** to be displayed on a conventional caller ID-enabled telephone or peripheral device.

Those of ordinary skill in the art will appreciate that the hardware depicted in **Figure 4** may vary. The depicted example is not meant to imply architectural limitations with respect to the present invention.

Figure 5 is a message flow diagram **500** illustrating call set up signaling when call originating telephone device **102** places a call to called telephone device **104**. IAM **502** is transmitted from CO **310** to STP **320**. IAM **502** includes various information such as an originating point code, a destination point code, and phone numbers of call originating telephone device **102** and called telephone

device **104**. Additionally, IAM **502** may include the name of the person to whom the subscription of call originating telephone device **102** is registered. The destination point code is a numeric address that identifies CO **312** as the destination CO that services called telephone device **104** assigned the telephone number dialed at call originating telephone device **102**.

Alternatively, the destination point code may provide an address of a signaling point used to route IAM **502** to CO **312**. STP **320** forwards IAM **502** to CO **312**. CO **312** examines IAM **502** and determines the dialed number. CO **312** then interrogates a subscription profile assigned to the called number by, for example, transmitting a transaction capabilities application part (TCAP) message **504** to SCP **330** that services called telephone device **104**. SCP **330** provides a front end to various databases, including LIDB **331**.

LIDB **331** includes information regarding subscription services, such as call screening and call forwarding information. For purposes of discussion, assume called telephone device **104** has a subscription record in LIDB **331** that provides an indication that call forwarding is enabled for called telephone device **104**. Further assume called telephone device **104** has elected to have all calls forwarded to forward-to telephone device **106** and that an indication thereof is included in the subscription record of LIDB **331**. SCP **330** forwards the subscriber information extracted from LIDB **331** including the forward-to number to CO **312** by, for example, TCAP reply message **506**. CO **312** then inserts a destination point code of CO **314**, or

alternatively a destination point code of a signaling point used for routing IAM **502** to CO **314**, into IAM **502**.

In accordance with a preferred embodiment of the invention, CO **312** inserts the telephone number of called telephone device **104** into a field of IAM **502** such that display of the called telephone number is enabled on conventional caller ID decoding equipment. Preferably, CO **312** inserts the called party number into a calling party name field of IAM **502**. CO **312** then forwards IAM **502** to CO **314** that provides switching services to forward-to telephone device **106** assigned the forward-to number specified by the subscriber record in LIDB **331**.

In the illustrative example, IAM **502** is forwarded to CO **314** via STPs **320** and **324**. CO **314** examines IAM **502** and determines that it services the forward-to number. CO **314** then rings forward-to telephone device **106** and transmits address complete message (ACM) **508** to CO **310** servicing call originating telephone device **102**. ACM **508** indicates the remote end of the trunk circuit has been reserved and is communicated to CO **310** via STPs **320** and **324**. The ring signal sent to forward-to telephone device **106** includes caller identification information. CO **310** then rings call originating telephone device **102** and completes the voice circuit between originating device **102** and forward-to telephone device **106**.

Forward-to telephone device **106** receives the ring signal from CO **314**. The caller ID information is extracted from the ring signal and displayed on device **106** suitably equipped with caller ID capabilities. Alternatively, the caller ID information may be displayed

on a caller ID peripheral device connected with the phone line of forward-to telephone device **106**. Caller ID information is transmitted to forward-to device **106** as, for example, FSK modem tones. The FSK-transmitted caller ID information may be sent as American Standard Code for Information Interchange (ASCII) formatted character codes.

Figure 6 is a diagrammatic illustration of IAM **502** as received by CO **312** in accordance with a preferred embodiment of the invention. The fields of IAM **502** shown and described are chosen only to facilitate an understanding of the invention and are not intended to provide an exhaustive description of an initial address message. Various other fields may be, and typically are, included within an initial address message.

IAM **502** is an American National Standards Institute (ANSI) Integrated Services Digital Network User Part (ISUP) message and includes a number of mandatory fields **510**, such as a circuit identification code value and a routing label. Message type field **512** includes an octet having a value that identifies the message as an initial address message.

An initial address message type is typically designated with an octet having a decimal value of "1" in accordance with SS7 standards. Called party number field **514** is set to the phone number of called telephone device **104**. IAM **502** includes fields for carrying calling party CID information. Calling party number field **516** includes the phone number of call originating telephone device **102** and calling party name field **518** may include the name of

the person to whom the subscription of call originating telephone device **102** is registered. Calling party name field **516** is nulled in the illustrative example. The calling party number and calling party name information in respective calling party number field **516** and calling party name field **518** may be encoded as ASCII-formatted character codes.

In accordance with a preferred embodiment, CO **312** parses CID information of called telephone device **104** and inserts the CID information of called telephone device **104** into IAM **502** in response to determining that the call is to be forwarded to forward-to telephone device **106**.

Figure 7 is a diagrammatic illustration of IAM **502** after processing by CO **312** in accordance with a preferred embodiment of the present invention. The telephone number of forward-to telephone device **106** may be inserted into called party field **514** during call forwarding processing performed by CO **312**. Calling party number field **516** retains the phone number of call originating telephone device **102** in the illustrative example. CID information of called telephone device **104** is inserted into calling party name field **518**. In the illustrative example, the phone number of called telephone device **104** is inserted into calling party name field **518**. Alternatively, the name of the person to whom the subscription of called telephone device **104** is registered may be inserted into calling party name field **518**.

Thus, forward-to telephone device **106**, or a caller ID peripheral device, equipped with caller ID capabilities will display the telephone number of calling

party number field **516** and the telephone number of called telephone device **104** in calling party name field **518**. Advantageously, a user receiving a phone call at forward-to telephone device **106** is provided caller ID information regarding the calling party as well as caller ID information of the called telephone device **104**.

As described, the present invention provides a methodology and computer program product for enabling the delivery of caller identification information regarding a called telephone device to a forward-to telephone device. A user having calls forwarded from multiple telephone devices to a single telephone device is able to ascertain to which of the multiple telephone devices a forwarded call was originally directed. The present invention may be implemented in a communication system with no hardware modification either to the signaling network or end user equipment. Preferably, the call-forwarding process described herein is implemented as a subscription service. A subscriber record may be modified to include the described call forwarding service option. Central offices may be adapted to perform insertion of CID information into a signaling message by a software modification.

It is important to note that while the present invention has been described in the context of a fully functioning data processing system, those of ordinary skill in the art will appreciate that the processes of the present invention are capable of being distributed in the form of a computer readable medium of instructions and a variety of forms and that the present invention

applies equally regardless of the particular type of signal bearing media actually used to carry out the distribution. Examples of computer readable media include recordable-type media, such as a floppy disk, a hard disk drive, a RAM, CD-ROMs, DVD-ROMs, and transmission-type media, such as digital and analog communications links, wired or wireless communications links using transmission forms, such as, for example, radio frequency and light wave transmissions. The computer readable media may take the form of coded formats that are decoded for actual use in a particular data processing system.

The description of the present invention has been presented for purposes of illustration and description, and is not intended to be exhaustive or limited to the invention in the form disclosed. Many modifications and variations will be apparent to those of ordinary skill in the art. The embodiment was chosen and described in order to best explain the principles of the invention, the practical application, and to enable others of ordinary skill in the art to understand the invention for various embodiments with various modifications as are suited to the particular use contemplated.